



$$(1 \text{ mi}) \times \left(\frac{1 \text{ ft}}{1 \text{ m}} \right) \times \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right) \times \left(\frac{1 \text{ ft}}{12 \text{ in.}} \right) = 3.28 \times 10^3 \text{ ft}$$

EVALUATE: A mile is a greater distance than a kilometer. There are 5280 ft in a mile but only 3280 ft in a km.

- 1.2. **IDENTIFY:** Convert volume units from L to in.³.

SET UP: 1 L = 1000 cm³. 1 in. = 2.54 cm

$$\text{EXECUTE: } 0.473 \text{ L} \times \left(\frac{1000 \text{ cm}^3}{1 \text{ L}} \right) \times \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right)^3 = 28.9 \text{ in.}^3$$

EVALUATE: 1 in.³ is greater than 1 cm³, so the volume in in.³ is a smaller number than the volume in cm³, which is 473 cm³.

- 1.3. **IDENTIFY:** We know the speed of light in m/s. $t = d/v$. Convert 1.00 ft to m and t from s to ns.

SET UP: The speed of light is $v = 3.00 \times 10^8 \text{ m/s}$. 1 ft = 0.3048 m. 1 s = 10^9 ns .

$$\text{EXECUTE: } t = \frac{0.3048 \text{ m}}{3.00 \times 10^8 \text{ m/s}} = 1.02 \times 10^{-9} \text{ s} = 1.02 \text{ ns}$$

EVALUATE: In 1.00 s light travels $3.00 \times 10^8 \text{ m} = 3.00 \times 10^5 \text{ km} = 1.86 \times 10^5 \text{ mi}$.

- 1.4. **IDENTIFY:** Convert the units from g to kg and from cm³ to m³.

SET UP: 1 kg = 1000 g. 1 m = 1000 cm.

$$\text{EXECUTE: } 19.3 \frac{\text{g}}{\text{cm}^3} \times \left(\frac{1 \text{ kg}}{1000 \text{ g}} \right) \times \left(\frac{100 \text{ cm}}{1 \text{ m}} \right)^3 = 1.93 \times 10^4 \frac{\text{kg}}{\text{m}^3}$$

EVALUATE: The ratio that converts cm to m is cubed, because we need to convert cm³ to m³.

- 1.5. **IDENTIFY:** Convert volume units from in.³ to L.

SET UP: 1 L = 1000 cm³. 1 in. = 2.54 cm.

$$\text{EXECUTE: } (327 \text{ in.}^3) \times (2.54 \text{ cm/in.})^3 \times (1 \text{ L}/1000 \text{ cm}^3) = 5.36 \text{ L}$$

EVALUATE: The volume is 5360 cm³. 1 cm³ is less than 1 in.³, so the volume in cm³ is a larger number than the volume in in.³.

- 1.6. **IDENTIFY:** Convert ft² to m² and then to hectares.

SET UP: 1.00 hectare = $1.00 \times 10^4 \text{ m}^2$. 1 ft = 0.3048 m.

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1-1

1-2 Chapter 1

$$\text{EXECUTE: The area is } (12.0 \text{ acres}) \left(\frac{43,600 \text{ ft}^2}{1 \text{ acre}} \right) \left(\frac{0.3048 \text{ m}}{1.00 \text{ ft}} \right)^2 \left(\frac{1.00 \text{ hectare}}{1.00 \times 10^4 \text{ m}^2} \right) = 4.86 \text{ hectares.}$$

EVALUATE: Since 1 ft = 0.3048 m, $1 \text{ ft}^2 = (0.3048)^2 \text{ m}^2$.

- 1.7. **IDENTIFY:** Convert seconds to years.

SET UP: 1 billion seconds = $1 \times 10^9 \text{ s}$. 1 day = 24 h. 1 h = 3600 s.

$$\text{EXECUTE: } 1.00 \text{ billion seconds} = (1.00 \times 10^9 \text{ s}) \left(\frac{1 \text{ h}}{3600 \text{ s}} \right) \left(\frac{1 \text{ day}}{24 \text{ h}} \right) \left(\frac{1 \text{ y}}{365 \text{ days}} \right) = 31.7 \text{ y.}$$

EVALUATE: The conversion $1 \text{ y} = 3.156 \times 10^7 \text{ s}$ assumes $1 \text{ y} = 365.24 \text{ d}$, which is the average for one extra day every four years, in leap years. The problem says instead to assume a 365-day year.

- 1.8. **IDENTIFY:** Apply the given conversion factors.

SET UP: 1 furlong = 0.1250 mi and 1 fortnight = 14 days. 1 day = 24 h.

$$\text{EXECUTE: } (180,000 \text{ furlongs/fortnight}) \left(\frac{0.125 \text{ mi}}{1 \text{ furlong}} \right) \left(\frac{1 \text{ fortnight}}{14 \text{ days}} \right) \left(\frac{1 \text{ day}}{24 \text{ h}} \right) = 67 \text{ mi/h}$$

EVALUATE: A furlong is less than a mile and a fortnight is many hours, so the speed limit in mph is a much smaller number.

- 1.9. **IDENTIFY:** Convert miles/gallon to km/L.

SET UP: 1 mi = 1.609 km. 1 gallon = 3.788 L.